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Morphology and Vocalizations of *Synallaxis unirufa* and *Synallaxis castanea* (Furnariidae, Aves), with Comments on Other *Synallaxis*

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ABSTRACT

Synallaxis unirufa and *S. castanea* of northern South America were considered to be conspecific by all modern authors until very recently, but they differ most distinctly structurally and in their vocalizations and are shown to be separate species. Another pair of birds (*azarae* and *elegantior*), which had also been considered conspecific, is separated specifically by a similar combination of morphological and acoustical characters. The study of the vocalizations is introduced by a general analysis of the vocalizations of other species of *Synallaxis*. This paper supports also the merging of *Poecilurus* with *Synallaxis*.

Synallaxis unirufa Lafresnaye, 1843, and *S. castanea* Sclater, 1856, replace each other geographically in northern Venezuela and were considered conspecific by all modern authors until the recent classification of the Furnariidae by Vaurie (1971). In this classification, Vaurie stated that *unirufa* and *castanea* are quite distinct species, and we present here the evidence to substantiate this opinion. The present paper also broadens

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into a general consideration of the vocalizations of other species of *Synallaxis*, which supports another opinion advanced by Vaurie in his classification, namely that *S. azarae* d'Orbigny, 1835, and *S. elegantior* Sclater, 1856, are also separate species, although they had been considered to be conspecific as were *unirufa* and *castanea*.

DISTRIBUTION

Synallaxis unirufa is a rather widely distributed Andean polytypic species that ranges from the Department of Junin in Peru, north to western Venezuela, including the Sierra de Perija in both Colombia and Venezuela, although not the massif of Santa Marta from which it is absent. In the Andes of Venezuela, the range of *unirufa* extends eastward through the states of Tachira and Merida to Trujillo. After a relatively broad gap in distribution, *unirufa* is replaced farther east by *castanea*, which is restricted to the Coastal Cordillera in the states of Aragua and Miranda and the Distrito Federal. The highest altitudes recorded for the two birds in Venezuela are 3200 meters for *unirufa*, but only 2200 for *castanea*, which is restricted to Venezuela, the lowest altitude being apparently 1300 meters for both species as neither has been recorded below this. This limitation to highland habitat probably explains the gap in distribution mentioned above between the eastern extreme of the main Venezuelan Andes and the Andes of the Coastal Cordillera which consists of unsuitable lowlands.

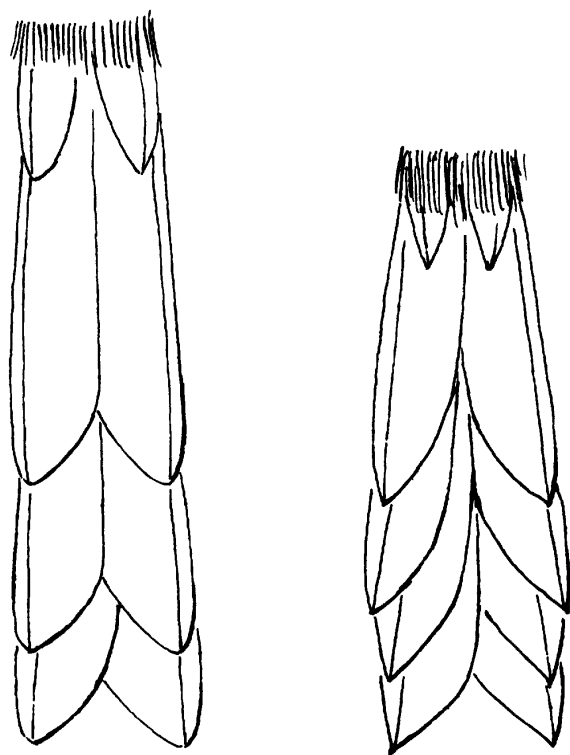
MORPHOLOGY

Synallaxis unirufa and *S. castanea* resemble each other in coloration, and the measurements of their wing and bill are virtually identical; the shape of the bill is also similar but the bill is somewhat more slender in *castanea*. In contrast, the two species differ conspicuously in the structure and length of tail (which results in quite different proportions), and differ slightly in the texture of body plumage which seems to be a little more silky and fluffy in *castanea*. The difference between the vocalizations of the two species is very marked and is discussed below in the consideration of the bioacoustical evidence. The measurements of adults of both sexes in millimeters are as follows:

S. unirufa, wing, 57–64 (60.85) in 52 specimens; bill (from skull), 15–18 (16.90) in 47 specimens; tail, 83–100 (86.28) in 42 specimens.

S. castanea, wing, 58–64 (61.20) in 50 specimens; bill, 16–18 (16.77) in 49 specimens; tail, 92–108 (100.14) in 50 specimens.

The plumage of *S. unirufa* and *S. castanea* is strongly rufous throughout and nearly uniform, *castanea* differing from *unirufa* by being paler, more reddish cinnamon, less reddish chestnut, and by having a conspicuous



Synallaxis castanea *S. unirufa*

FIG. 1. Structure of the tail in *Synallaxis castanea* and *Synallaxis unirufa*.

black gular patch; this patch exists also in *unirufa* but is completely concealed by the broad chestnut tips of the feathers. This virtually uniform rufous plumage, which is not matched by any other member of the genus, suggests that *unirufa* and *castanea* are probably related, but we believe that the distinct differences in structure and vocalizations establish that they are not conspecific.

The difference in the structural characters of the tail is shown in figure 1 which was drawn from actual specimens selected as being fully adult with perfectly fresh feathers. The tail of *unirufa* is composed of 10 rectrices that are acuminate at the tip, whereas the tail of *castanea* is composed of only eight rectrices that are more rounded and blunter at the tip. The webs are broader in *castanea* and invariably better integrated in any degree of wear, whereas in *unirufa* the webs are narrower and become quickly somewhat

semi-decomposed. The graduation of the rectrices is also quite different, the tail of *castanea* being more supple, more "elastic," and less stiffened than that of *unirufa*.

The genus *Synallaxis* has been characterized since the basic review of Sclater (1890) by having 10 rectrices. This remained unquestioned until the classification of Vaurie (1971), but, as Vaurie showed, the number of rectrices varies from species to species in *Synallaxis* and the outer pair is undergoing a definite and progressive reduction with all sorts of intermediates, which ultimately results in its complete elimination. One species (*hellmayri*), from a total of 36 for the genus, has 12 rectrices, 27 species have 10, in one (*cinnamomea*) the number varies from 10 to eight, and seven species have only eight. The species with eight rectrices include *castanea*, *azarae*, and also *ruficapilla*—the type of the genus—a most unorthodox fact for a genus said to be characterized by having 10 rectrices.

The number of rectrices is therefore not a generic character, but is often diagnostic at the species level. Vaurie reached this conclusion before he had any knowledge about vocalizations. It was based chiefly on morphology, but this conclusion was well supported later by the only two species pairs for which comparative recordings can be studied. These two pairs are *unirufa* and *castanea* on the one hand, *elegantior* and *azarae* on the other, *unirufa* and *elegantior* having 10 rectrices, as against eight for *castanea* and *azarae*. This fact suggests, perhaps, that differences in vocalizations will be found to be associated with differences in morphology in the case of other pairs of species.

The fact that the tail of *castanea* is composed of only eight rectrices attracted the attention of Sclater (1856) when he described *castanea*. His comments imply that he was aware that the outer pair is disappearing in *Synallaxis*, but when he reviewed the Furnariidae later (1890), he did not mention the number of rectrices and characterized *Synallaxis* as having 10.

The reason for this change in systematic opinion is obscure but perhaps Sclater had come by then to the conclusion that all the specimens of *castanea* he had seen were abnormal. However, specimens with more than eight rectrices were apparently unknown until S. M. Klages collected two birds with one additional rectrix on the left side of the tail on October 17 and December 9, 1913, at Galipan, Cerro de Avila, Distrito Federal. These are the two specimens which Hellmayr (1925) mentioned as having 10 rectrices. He stated, "While eight is the normal number [in *castanea*], I find two individuals with ten rectrices among the series of seventy-four skins examined in the present connection." Vaurie succeeded in tracing 70 of these 74 specimens, the large majority of which were collected by Klages between October, 1913, and February, 1914.

The two specimens with nine rectrices were located for Vaurie by Gerd Diesselhorst in the Zoological Museum of Munich in a series of 39 that was examined by Hellmayr; Diesselhorst sent the two specimens to Vaurie. The fact that the additional rectrix (the ninth) is present only on the left side was noted by Hellmayr on the labels, but as he also added that the right side of the tail was "imperfect" or "moulting" he apparently assumed that these two birds would have had 10 rectrices. But close examination fails to reveal any evidence of an additional rectrix on the right side, and, evidently, reduction in the number of the tail feathers is proceeding also in *castanea* from an original 10 to, now, only eight normally.

Fifty-eight specimens of *castanea* were examined personally by Vaurie, and, with the exception of the two birds with nine rectrices, all the others have eight. Other specimens examined at Vaurie's request are the balance of the series in Munich (37 specimens) and 28 specimens in the Colección Ornitológica Phelps in Caracas. The tail feathers were not counted in 13 specimens in Caracas because the tails were damaged, but the remainder and the specimens in Munich have eight rectrices. The material examined by Vaurie includes all the specimens of *castanea* seen at any time by Sclater, including the two cotypes which are in the Muséum National d'Histoire Naturelle in Paris.

VOCALIZATIONS

The bioacoustic evidence was gathered and studied by Schwartz but the present paper is written jointly. Certain terms that are employed below are defined as follows.

Figure: Sound which produces a single, complete and distinct impression—usually represented on a spectrogram as an uninterrupted trace.

Frequency: The number of vibrations or cycles of a given sound in a unit of time, usually expressed in cycles or kilocycles per second (Hz, KHz).

Pitch: The subjective interpretation of frequency. This interpretation is influenced not only by the frequency, but also by the intensity of the sound as well as by its harmonic content.

Amplitude: The degree of loudness of a sound.

The vocal pattern of non-oscine birds appears to be under rigid genetic control, as a rule. Consequently, the vocal pattern of any given species is consistent throughout the range of the species although it may show minor geographical variations. The spectrograms of *S. cinnamomea* from the Coastal Cordillera of Aragua (fig. 2d), and from extreme western Lara (fig. 2e) are somewhat different but well within the range of individual variation.

The vocalizations of *S. unirufa* (fig. 4) and those of *S. castanea* (fig. 5) are

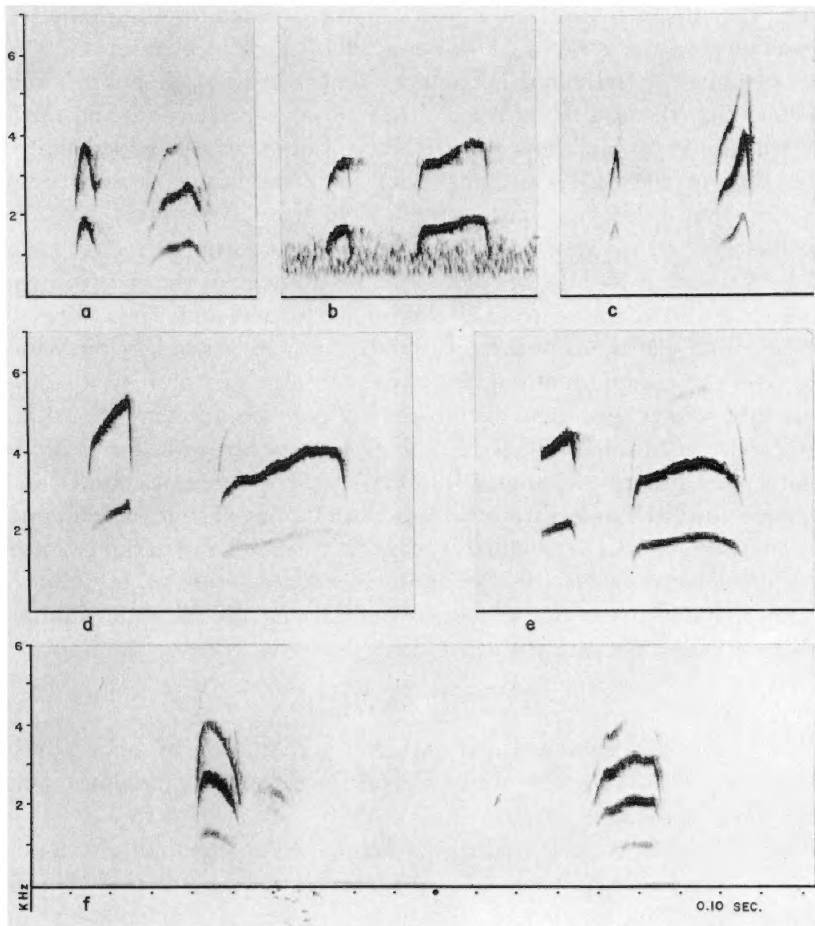


FIG. 2. Sound spectrograms of typical "song" phrases of some species of *Synallaxis*: a, *S. rutilans* (Venezuela); b, *S. azarae* (Peru); c, *S. elegantior* (Venezuela); d and e, *S. cinnamomea* (Venezuela); f, *S. gujanensis* (Venezuela).

compared with those of other species (figs. 2 and 3) for which recordings are available. These vocalizations serve, no doubt, to ensure contact and, in *Synallaxis*, seem to be homologous to the primary song of other groups of birds.

The "song" of *Synallaxis* is, generally speaking, a constant repetition of a stereotyped phrase that consists of two or three figures in the majority of the species studied. The individual figures of the phrases may be as short as 0.02 second, or less, but can be as long as 0.30 second. The time interval between the figures of a single phrase is usually less than 0.25 second, and

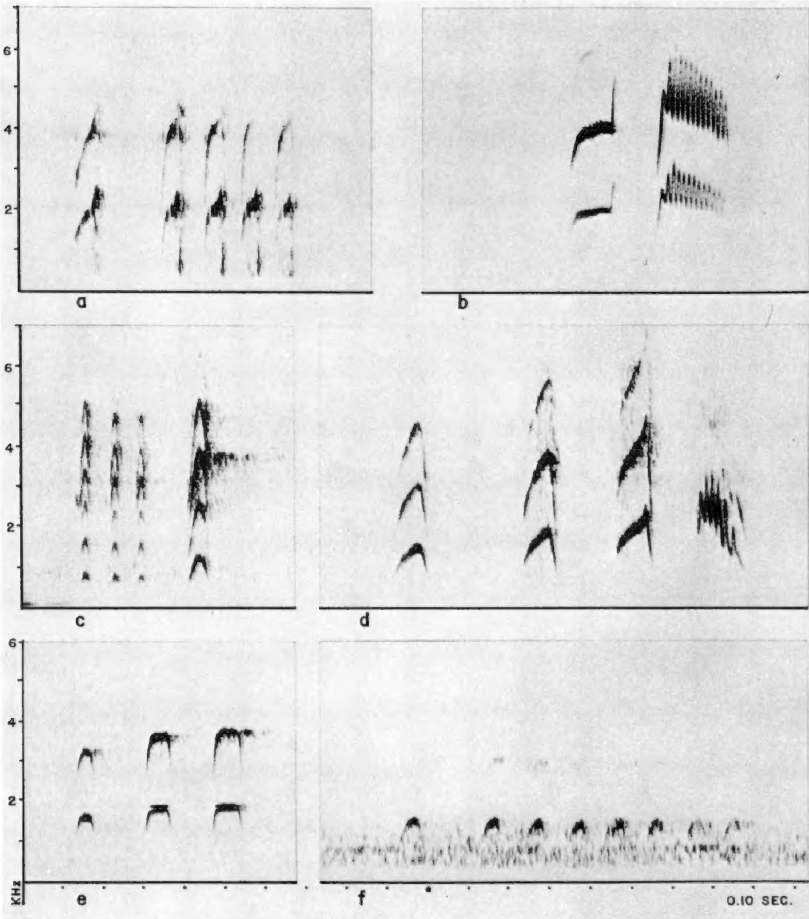


FIG. 3. Sound spectrograms of typical "song" phrases of some species of *Synallaxis*: a, *S. spixi* (Brazil); b, *S. albescens* (Venezuela); c, *S. ruficapilla* (Brazil); d, *S. erythrothorax* (Mexico); e, *S. candei* (Venezuela); f, *S. albigularis* (Peru).

the interval between phrases usually one second or more. Thus each phrase is readily distinguishable as one unit; this is true even when the bird is excited and sings more rapidly than normally.

The phrase of *S. gujanensis* (fig. 2f) is rather unusual in the long interval that separates the final figure; in many individuals the interval is appreciably longer than shown (fig. 2f). However, as the interval between phrases is then correspondingly longer, the phrase can be distinguished without difficulty.

When the phrase of a particular species is comprised of more than two

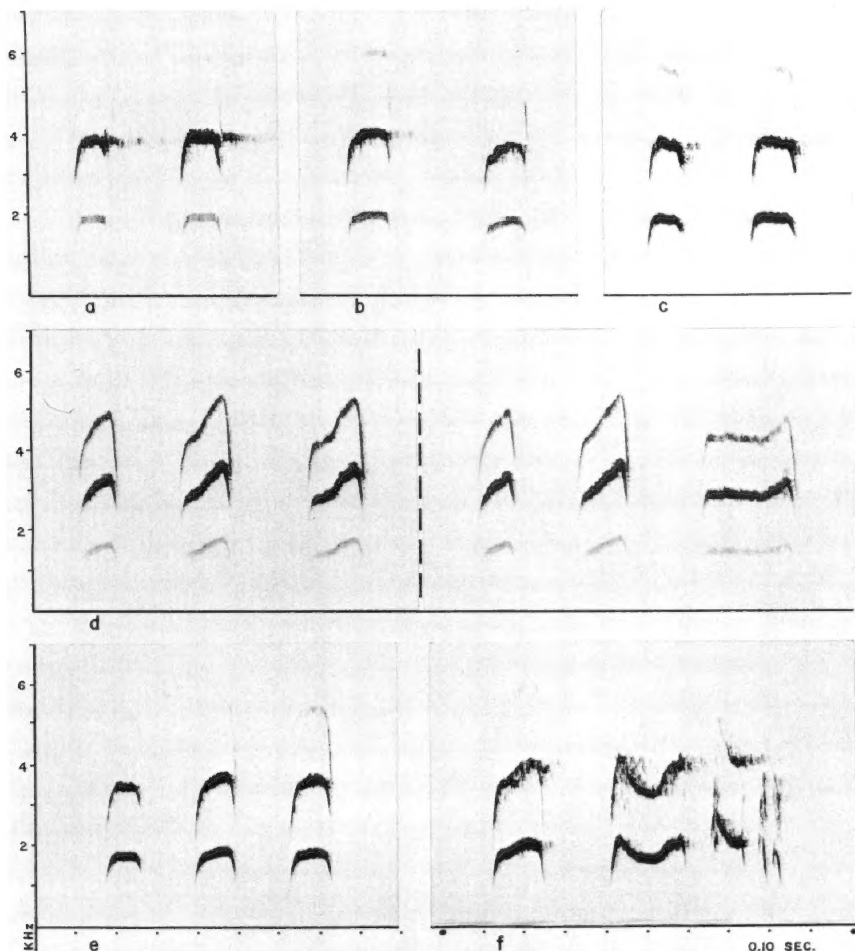


FIG. 4. Sound spectrograms of various vocalizations of *Synallaxis unirufa meridana* (see text).

figures, one of these figures is separated from the others by a longer interval. Also—independent of the actual number of figures—one of the figures usually differs from the other figures of the phrase by being louder or softer, and/or shorter or longer, and its frequency is also different.

Many variations are possible and combine to produce a different song for each species that most probably serves for recognition. Some phrases of different species may appear to be similar at first glance, for instance in *S. azarae* (fig. 2b) and *S. cinnamomea* (fig. 2e), but closer inspection reveals that the second figure in the phrase of *azarae* is at a slightly higher frequency

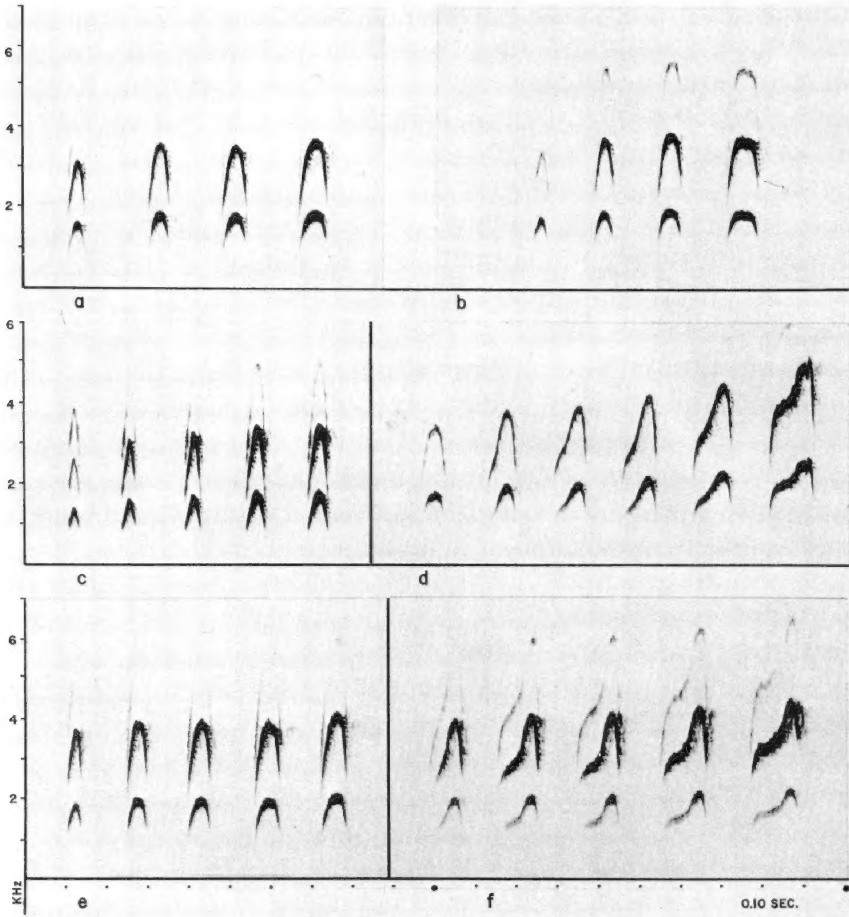


FIG. 5. Sound spectrograms of various vocalizations of *Synallaxis castanea* (see text).

than the first figure, whereas it is at an appreciably lower frequency in *cinnamomea*. These species differences persist throughout normal variations; the song may at times be given at a higher or lower frequency but the relationship of the parts remains essentially the same—for instance, *cinnamomea* does not produce a second figure at a higher frequency than the first.

Some species of *Synallaxis* may vary their song occasionally. *Synallaxis candei* has been heard to give a two-figure phrase in a series of the normal three-figure phrases. *Synallaxis cinnamomea* adds occasionally a series of three to six figures similar to the second figure of its normal phrase, but

with each successive figure slightly shorter, sharper, and higher pitched; at times, the series terminates with a short trill at a lower pitch and amplitude. *Synallaxis erythrothorax* is known to vary the number of figures in its phrase from two to five. The extensive field experience of Schwartz has not revealed, however, variations in *S. albescens*, *S. rutilans*, *S. elegantior*, or *S. gujanensis*, with the exception noted above.

It is certain that other vocalizations are produced, of course, such as contact, alarm, conflict, and so on. These may consist of either single calls, "rattles" that are more or less prolonged, or chatter, but these vocalizations usually lack a regular pattern.

VOCALIZATIONS OF *Synallaxis unirufa*

The vocalizations of the Venezuelan populations of this species (fig. 4) conform with those of other *Synallaxis*. The normal song consists usually of two-figure phrases, three examples of which are shown. Phrases a and b are those of a pair, presumably mated, recorded in west-central Merida; phrase c is from a bird recorded in northeastern Trujillo.

The figures of these phrases are characterized by being somewhat protracted at maximum amplitude, with little change in pitch, although the frequency increases rapidly at the beginning and decreases rapidly at the end. Both figures have essentially the same frequency, but normal variations may result in a slight shift, one of the figures being at a slightly lower or higher frequency than the other.

This species also uses a three-figure phrase. These may be injected into a normal song period but occur more frequently in a territorial reaction; phrase e represents such a case.

The two phrases of figure 4d were recorded in northeastern Tachira from an individual that was rather excited. Song of this type, employing the two-phrase patterns shown, has been heard in several localities throughout the Venezuelan Andes and is obviously part of the repertoire of *S. unirufa*. Analysis of another recording of this song-type shows figures less sharply peaked than in the phrases illustrated. In a song session of this kind, phrases with a pattern similar to that on the left are generally more frequently used than those resembling the right-hand pattern. Birds that are highly excited have infrequently been heard to give phrases of four or five figures.

The vocalizations discussed above are those normally heard by Schwartz during frequent field experience. A different song (fig. 4f), the significance of which is not completely clear, has been heard rarely. It seems to be sung only at dawn and appears to be a kind of "dawn song," although it is not given generally throughout a region as is dawn song in other birds. It has

been heard only in March and April and may be related to some phase of the annual cycle in mating behavior.

VOCALIZATIONS OF *Synallaxis castanea*

The vocalizations of *Synallaxis castanea* (fig. 5) differ from those of *S. unirufa* in the number of figures comprising the phrases, as well as in the shape of the figures. In *S. castanea* the figures are generally shorter and more acute, and in the usual song the phrases are comprised of four or five figures, rarely three or six. Phrases a, b, c, and e are of different individuals, but it appears that any one individual may produce phrases with patterns similar to any of those shown. Phrases of five figures seem to indicate a greater degree of intensity and in normal territorial reactions are used more frequently than four-figure phrases.

A slightly different song-type is illustrated by phrases d and f. This song is used rather regularly as dawn song. It seems also to be employed in high-level territorial reactions. The phrases consist of five or six figures (infrequently seven or four) which may be of essentially the same pitch throughout (f), or may increase pronouncedly in pitch as the phrase develops (d).

Recorded vocalizations of *S. unirufa* and *S. castanea* were played to both species following a program that alternated several minutes of song of each species with a pause between each. Playback was always initiated with the vocalizations of the absent species and continued through at least two complete cycles. It was observed that in all such trials, which resulted in any reaction at all, each species reacted normally to song of its own species but not to that of the other species.

In short, the acoustical evidence supports very well the taxonomic opinion of Vaurie (1971), who had separated the two birds specifically on morphological characters.

COMMENTS ON OTHER SPECIES

The tips of the rectrices are broad and blunt in *Synallaxis candei*, and Todd (1917) proposed the new genus *Poecilurus* for this species. Two other species were added later to *Poecilurus*, but the shape of the tail feathers varies a great deal specifically in *Synallaxis* from more or less acuminate to blunt, and Vaurie (1971) does not consider that the shape is a generic character; he merged *Poecilurus* with *Synallaxis*. The only species of "*Poecilurus*" with which Schwartz is acquainted is *S. candei* (subspecies *venezuelensis*). His field experience with this bird is rather limited but indicates that in both general habits and vocalizations, *candei* is perfectly compatible in *Synallaxis*.

The song phrase of *candei* (fig. 3d) is very similar to the normal song phrase of *S. unirufa* (fig. 4) both in frequency and pattern.

Vaurie has also advanced the opinion that *S. azarae* and *S. elegantior* were incorrectly believed to be conspecific. His opinion was based chiefly on morphology (see above), but is found to be substantiated by the acoustic evidence. Figure 2 shows at once that the phrases of these two birds are very different in duration and peaking of the figures, phrase b being that of *azarae*, and phrase c that of *elegantior*. Observations made by Schwartz when playing back the recorded vocalizations of *azarae* to *elegantior* indicated that *elegantior* readily distinguishes between its song and that of *azarae*.

MATERIAL AND ACKNOWLEDGMENTS

This study was based on both specimens and recordings. The latter were made by Schwartz in Venezuela, or obtained as follows: *S. azarae* and *S. albigularis* recorded by John S. Weske in Peru; *S. ruficapilla* recorded by Rodman Ward in Brazil; *S. spixi* taken from a phonograph record, "Voices of the Brazilian Jungle," S.O.M., recordings by Johan Dalgas Frisch; *S. erythrothorax* from a phonograph record, "Mexican Bird Songs," Cornell Laboratory of Ornithology, recordings by L. Irby Davis. Schwartz expresses his appreciation to Messrs. Weske and Ward for kindly supplying copies of their recordings, as well as to Mr. Davis and the Cornell Laboratory of Ornithology, and to Dr. Frisch, for use of the material from their records. The spectrograms were prepared by Schwartz at the Estación Biológica de Rancho Grande, Maracay, Aragua, Venezuela, with a Kay Electric Company Sona-Graph, model 6061 A, at normal speed, using the FL-1 equalization, 150 Hz band pass filter, and with the record and reproduce level at less than -10 VU.

Some specimens were seen by Schwartz, but their study was carried out by Vaurie, using the collection of the American Museum of Natural History, New York, and other material examined by him in the British Museum (Natural History), London, and the Muséum National d'Histoire Naturelle, Paris, or lent to him by other institutions. Loans were received from the Carnegie Museum, Pittsburgh, through Kenneth C. Parkes; Field Museum of Natural History, Chicago, through Emmet R. Blake; and the Zoologische Sammlung des Bayerischen Staates, Munich, through Dr. Gerd Diesselhorst. Information was supplied also by William H. Phelps, Jr. on the material in the Colección Ornitológica Phelps in Caracas, and by Gottfried Mauersberger on the specimens in the Zoologisches Museum in Berlin. Vaurie wants to express his appreciation to all the persons and institutions named, for a very cordial reception in

London and Paris, and is especially grateful to Dr. Diesselhorst for his observations on Hellmayr's material in Munich and other comments on the species.

We both express our thanks to Dr. Wesley E. Lanyon of the American Museum of Natural History for reading a draft of this paper.

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